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IN

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A FEW ADDITIONAL EXPLANATORY NOTES.

BY

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AT ST. BARTHOLOMEW'S HOSPITAL.

LONDON:
S. HIGHLEY, 32, FLEET STREET.

1835.

LONDON :
PRINTED BY STEWART AND CO.,
OLD BAILEY.

TRANSLATOR'S PREFACE.

The reputation of M. Jules Cloquet, as an accurate Anatomist, is so well established throughout Europe, that no apology, it is presumed, can be necessary in presenting to the Profession a translation of any of his writings. This observation will particularly apply to the following pages, which are the result of the most laborious and careful investigation of the subject to which they relate.

The work here translated was published in the year 1817, and entitled "Recherches Anatomiques sur les Hernies de l'Abdomen." It is held in great estimation by the most experienced Anatomical Teachers; and the numerous quotations from it by many distinguished Authors, sufficiently attest its merits.

Such are the considerations which rendered it desirable that so excellent a description of the parts concerned in Inguinal and Femoral Hernia, should be placed within the reach of every student.

For the sake of abbreviating, and thereby increasing the practical usefulness of the translation, several passages in the original, which were deemed com-

paratively less important, have been omitted. On the other hand, the Translator has ventured to introduce a few short notes, which may perhaps be serviceable to those who are commencing the study of this important branch of Surgical Anatomy.

5, Crescent, New Bridge Street,
November, 1834.

ANATOMICAL DESCRIPTION

OF THE PARTS

CONCERNED IN INGUINAL HERNIA.

APONEUROSIS OF THE EXTERNAL OBLIQUE MUSCLE.

The broad and strong aponeurosis, by which the Obliquus Externus Abdominis terminates anteriorly, passes inwards towards the linea alba, which it contributes to form by uniting with the aponeurosis of the opposite muscle at the median line. Below the aponeurosis is fixed externally to the anterior superior spine of the ilium, and internally to the upper part of the pubes. Its inferior border, extended between these two points, is, as it were, folded upon itself. It is commonly called the ligament of Fallopius, Poupart's ligament, or the Crural Arch.

The fibres of this aponeurosis parallel to each other, and stronger in proportion as they are inferior, follow a direction downwards and inwards. Near the pubes they separate into two fasciculi, which are known by the name of Columns of the Inguinal Ring. Of these columns, one is internal and superior; it is broad and flattened, and is fixed to the front part of the symphysis pubis, its fibres crossing those of the opposite side. The other is external and inferior; it is of a rounded form, and much stronger than the in-

ternal column — it is attached to the spine of the pubes, and there is an extension of it to the crista of the pubes, which will be hereafter described. Between these two aponeurotic columns there is a triangular aperture; the Ring of the external oblique or the Inguinal Ring.[1] *

In the male, this aperture gives passage to the spermatic cord, and in the female to the round ligament of the uterus. Its base[2] is formed by the pubes, its sides by the columns. Its summit,[3] situated superiorly and externally, is the point where the fibres of the aponeurosis of the external oblique separate into the two fasciculi. The summit is rounded in consequence of superficial aponeurotic fibres taking a transverse direction, and uniting the two columns which they cross at an angle more or less acute.

These transverse fibres arise from the lower part of the Crural Arch, where they are closely collected together; from thence they proceed in a radiating manner obliquely upwards and inwards towards the linea alba; a portion of them cross in front of the Inguinal Ring, which they narrow, and then become lost in the aponeurosis of the external oblique. In some individuals they are strongly developed, whilst in others they are very thin, or can scarcely be said to exist: many times I have been unable to discover them. In the female they are much weaker than in the male; they prevent the separation of the columns, and strengthen the lower part of the aponeurosis; which, indeed, is of greater thickness in this situation than elsewhere.

The great diameter of the inguinal ring is parallel to Poupart's ligament; so that the summit is towards the anterior superior spine of the ilium, whilst its base is

[1] Ordinarily this aperture is triangular; but its form and dimensions are subject to great variety both in its healthy and in its diseased state.

[2] The internal angle of the inguinal ring.

[3] The external angle of the inguinal ring.

* *It is also termed the External Abdominal Ring, or Inferior Opening of the Inguinal Canal.* —Translator.

towards the pubes. The circumference of the ring gives origin to a very thin cellular expansion,* which surrounds the cremaster muscle, and is soon lost upon the spermatic cord, by being confounded with the cellular covering, which the latter receives from the fascia superficialis; but from which it was at first quite distinct.[1]

FASCIA SUPERFICIALIS.

The aponeurosis of the external oblique is covered throughout by a thin membrane, which passes upon the spermatic cord, to which it furnishes a covering.† The following is what I have learned of it from careful dissection. First being simply formed by a whitish and condensed cellular tissue, it covers the abdominal muscles and aponeuroses; it adheres but slightly to the latter, but is so intimately connected with the muscles as to render their dissection difficult. Internally, it is continuous with that of the opposite side, by passing in front of the linea alba, from which it is separated with facility; externally it passes to the crista of the ilium, becomes entirely cellular, and then covers the glutæus maximus and medius; in front of the abdomen it is difficult to ascertain the precise direction of its fibres; it contains the subcutaneous vessels of the abdominal parietes; inferiorly it passes in front of Poupart's ligament, to the external part of which it is rather

[1] The inguinal ring is of less extent, and its columns are not so strong in the female as in the male. Sometimes it consists of a very small rounded aperture, closely embracing the spermatic cord or the round ligament; in other instances it has a very elongated form, and the spermatic cord passes out through its external angle and over the inferior column, at some distance from the pubes. In several subjects I have found the columns joining each other at a distance not exceeding one or two inches from the anterior superior spine of the ilium; the ring in such instances was of considerable size, and the oblique fibres which crossed it gave it a square form.

* *This cellular expansion constitutes the inter-columnar fascia of some authors; it is also represented as becoming the tunica aponeurotica of inguinal hernia.*—T.

† *The fascia superficialis may be described as consisting conjointly of the fibro-cellular and adipose tissues situated between the skin and aponeurosis of the external oblique, or of the fibro-cellular tissue alone.*—T.

strongly adherent. Surrounding the external abdominal ring without being firmly connected with it, the Fascia Superficialis extends upon the spermatic cord, to which it gives, as above-mentioned, a thin cellular sheath, easily separated, and which accompanies it to the bottom of the scrotum. This sheath also embraces the tunica vaginalis and the testicle, and identifies itself lastly with a white and triangular fasciculus of fibres, which connect the latter organ to the scrotum and ramus of the ischium, (they are the remains of that structure which J. Hunter called the Gubernaculum testis.) In many individuals this sheath is so thin that the fibres of the cremaster as well as the vessels of the cord which it surrounds may be seen through it. Two or three superficial arteries derived from the femoral, pass transversely, some in front of, others behind the cord to the root of the penis: they are contained in the substance of the fascia now described, and are accompanied by veins, which terminate in the femoral vein, through the opening in the fascia lata which gives passage to the vena saphena. On the inner side of the external ring, the fascia superficialis extends to the root of the penis, and is continuous with the loose cellular tissue by which the penis is surrounded.

Below the crural arch, the fibres of this fascia are very distinct; they are parallel to the bend of the thigh, and form meshes of considerable size, irregularly disposed, leaving spaces filled with fat or lymphatic glands. Externally it reaches the outer part of the thigh, and rests upon the surface of the fascia lata, which it also covers internally, and where it is fixed above to the ramus of the ischium near to the root of the corpus cavernosum.

The fascia superficialis passing in front of the aponeurotic opening for the vena saphena, adheres more or less intimately to its edge, and afterwards descends upon this vein, by which it is separated from the fascia lata.

The fascia superficialis is very thin and indistinct, and is as it were altered in structure in fat subjects. In thin subjects, it is thicker, of a whitish colour, and more easily

dissected. It does not add materially to the strength, either of the external ring, or of Poupart's ligament.

OBLIQUUS INTERNUS ABDOMINIS.

Beneath the external oblique, we find the lesser or Internal Oblique muscle of the abdomen, the fibres of which are attached to the middle part of the crista ilii, to the anterior superior spine of the same bone, and to the crural arch; superiorly, its aponeurosis separates, at the external border of the rectus muscle, into two layers: one, the anterior, passes in front of this muscle with the aponeurosis of the external oblique, to which it strongly adheres, to be attached to the linea alba; the other, or posterior layer, thinner than the first, slides behind the same muscle with the aponeurosis of the transversalis, and terminates also at the median line. These two layers, by their separation, form the sheath of the rectus muscle. Inferiorly, the aponeurosis of the internal oblique consists only of one layer, which unites with the aponeuroses of the external oblique and transversalis, and accompanies them in front of the rectus. In this situation, the aponeuroses of the three muscles are intimately united, and become fixed to the linea alba. When the pyramidalis exists, as it most frequently does, it is enclosed in a sheath, formed anteriorly by the united aponeuroses of the external and internal oblique, and posteriorly by the layer derived from the transversalis. The inferior fibres of the internal oblique take a direction nearly transverse: they are usually intermixed with those of the transversalis muscle which is placed behind it. They are attached externally to the crural arch; internally, to the upper part of the pubes, between its spine and angle, and immediately behind the inner column of the external ring. The inferior edge of the internal oblique is parallel to Poupart's ligament. In some subjects it is separated, and distinct from that of the transversalis; in others, on the contrary, it is intimately connected with it, and cannot be separated. The following is what I have been able to deter-

mine upon this subject, by numerous careful dissections. The lower border of the transversalis, composed of very thin pale fibres, passes in a transverse direction above the spermatic cord, at the point where it enters the inguinal canal; that is, on a level with the superior opening of this canal: internally, it is inserted into the lower part of the linea alba, and slightly into the pubes, by uniting with the aponeurosis of the internal oblique. The inferior edge of the latter, attached as I have stated, to the crural arch, descends parallel to it, covering the spermatic cord in the inguinal canal, and is fixed inwardly to the pubes. It passes over the cord, just at the point where the latter escapes from the inferior opening of the inguinal canal. The fibres of the internal oblique there change their direction, to give origin to the Cremaster,—those fibres which were, straight and nearly horizontal, become curved and vertical. They pass through the ring, and then, descending below it, form, in front of the cord, loops or arches, with their concavities directed upwards, and which may be traced to the bottom of the scrotum. The fibres are applied upon the whole of the anterior surface of the tunica vaginalis, and of the spermatic cord.—(See Plate II. N N.) These arches are of greater extent, inferiorly: occasionally, one of them, single at its extremities, separates into two, towards its middle, and encloses a sort of crescentic space. They are all united, towards the external ring, into two triangular fasciculi. The one external (Plate II. P), and the stronger, passes through the corresponding part of that aperture; the other, internal, (Plate II. O), and less developed, enters the ring, behind the inner column, to be attached to the pubes. This disposition, which is constant, has been but imperfectly understood by anatomists. The greater number have only described the external fasciculus of the cremaster; others have spoken only in a vague manner of the fibres which are inserted into the pubes. No anatomist, to my knowledge, has described those muscular arches which I have shown to exist in front of the spermatic cord; I therefore think it useful to treat this part of the anatomy in detail.

The lower fibres of the internal oblique, in most subjects, passing through the external ring, at first form arches of small extent, their concavities being turned upwards. They pass out from the external angle of the ring in front of the cord, and almost immediately ascend behind the internal column to be fixed to the pubes. The succeeding arches are, as I have noticed, more and more developed. Occasionally, both in the healthy subject and upon herniæ, they preserve their muscular texture to the extent of six inches below the ring. It is, however, only by a very careful dissection that we can distinguish these fibres in front of the testicle and tunica vaginalis; for they are in this situation pale and thin: in the latter case, which is very common, the cremaster is insensibly lost upon the lower part of the proper sheath of the spermatic cord. In many subjects, the same disposition of the cremaster is found, not only in front of, but also behind the cord. The posterior arches are much less distinct than the anterior: they form acute angles rather than curves.

According to the description which the greater number of anatomists give of the cremaster, which they consider as extending only upon the external part of the cord, the testis would appear imperfectly suspended. I have dissected, in a great many subjects of different ages, the spermatic cord and its coverings, and I have, with a few exceptions, which I shall point out, found this muscle to possess the anatomical character now described.

The cremaster muscle does not exist before the period at which the descent of the testicle takes place; it is formed in proportion as this organ, which is drawn down by the gubernaculum, passes from the abdomen into the scrotum. I have assured myself of this fact by many dissections of the fœtus prior to, as well as during and after, the period of the descent of the testis. The examination of the parts is extremely difficult in the fœtus of not more than five or six months; the lower fibres of the internal oblique are soft, and of a reddish colour; the cellular tissue is also in the same state, and infiltrated by a viscous fluid, in which the adipose vesicles are

dispersed. On clearing away this albuminous fluid, the muscular fibres become much more distinct; they are remarkably loose, and leave Poupart's ligament, to which they are attached, passing in front of a greyish cord, formed by the gubernaculum testis, which at this period alone occupies the inguinal canal. These fibres of the internal oblique are, therefore, completely enclosed within this canal: towards their middle they adhere somewhat closely to the gubernaculum; and when this part is drawn downwards, they are seen to descend with it through the external ring, forming successively curves, whose concavities are turned upwards, and which afterwards become developed upon the testis and the spermatic cord. The laxity of these inferior fibres facilitates their elongation, and finally their descent through the external ring. By drawing down the gubernaculum, we simulate in some degree the natural descent of the testis, and form an artificial cremaster.

If the aponeurosis of the external oblique is turned down, (Plate I. fig. 2. B.) in a fœtus in which the testis has escaped through the ring, and the internal oblique thus exposed, its lower border (Plate I. fig. 2. D.) is seen to extend itself to form the cremaster, as in the adult. At this period, when the tunica vaginalis has a communication with the cavity of the peritoneum, we may succeed occasionally in returning the testis into the abdomen; the cremaster is made, in this manner, to retrace its course; or, more properly, we return to the internal oblique the fibres which the cremaster borrowed for its formation. In proportion as the testis is raised towards the abdomen, the muscular arches are seen to ascend towards each other, and soon to return into the inguinal canal, at last reproducing the inferior border of the internal oblique. This border is, however, much looser than it was prior to the descent of the testis; and appears folded upon itself. It descends again with the greatest facility, when the testis is allowed to escape into the scrotum, and the cremaster then re-appears. The two triangular fasciculi, which were almost effaced, now resume their former figure. (Plate I. fig. 2. G H.)

In a great number of subjects of all ages, I have invariably

found these festoons or arches which I have described; they are, however, more or less distinct in different individuals. My researches have been directed with care, as to the manner in which these muscular fibres are disposed, both in internal and external inguinal herniæ; and also with the view of inquiring what changes they undergo, &c. At a future period I will make known the result of my investigations on the subject; I will simply here observe, that the hernial sac in descending, acts in a manner similar to the gubernaculum testis, and augments the number of the fibres of the cremaster at the expense of those of the internal oblique, which it draws down with it through the inguinal ring.[1]

In the majority of subjects, the spermatic cord passes underneath the lower border of the internal oblique, which it draws with it, to form the cremaster, as I have explained. In these cases, the anterior festoons or arches only exist; but in some individuals, it evidently traverses the fibres of this muscle, and these arches exist then not only in front, but also behind the testis and tunica vaginalis, which thus become every where surrounded by them. All subjects are not equally favourable for the examination of these parts, for in some, the greater arches exist on the exterior and internal part of the cord, they being wanting on its anterior surface; in others, the smaller ones are the most marked.

It is evident from my description of the cremaster, 1st, that this muscle is formed by the lower fibres of the internal

[1] With the view of obtaining a clear idea of the cremaster muscle, the aponeurosis of the external oblique and the inguinal ring must be exposed, and the fascia superficialis removed from the spermatic cord; the aponeurosis of the external oblique is next to be divided transversely, a hand's breadth above the ring, and detached from the linea alba; on turning it down, we perceive the lower fibres of the internal oblique covering the spermatic cord in the entire length of the canal. On dividing with care the upper part of the ring, the inferior fibres of the internal oblique are observed to throw themselves, as it were, in front of the spermatic cord, and to form the inverted arches, which may be traced downwards to a greater or less extent. According to this new mode of considering the cremaster, we may regard the external fasciculus as constituting the origin of the muscle; and the fibres of which, after separating from each other, unite, to terminate at the pubes by the internal fasciculus.

oblique, which are drawn through the ring by the gubernaculum and testis, to which they adhere at the period of the descent of this organ; 2dly, that it forms an envelope, which sometimes covers the testicle and cord only in front, and sometimes surrounds them on all sides; 3dly, that in either case, the fleshy fibres of this envelope unite into two triangular fasciculi, one occupying the inner, the other the outer side of the abdominal ring; 4thly, that the cord usually passes beneath the fibres of the internal oblique, but sometimes between them, the cremaster muscle owing its form to the manner in which the former has passed in relation to these fibres; 5thly, that the testis, as well as the sac of an external inguinal hernia, when it exists, are sustained on every side, and not simply on the outer side, as might be imagined from the usual description of the cremaster.

It is easy to explain, from what I have said, the spontaneous reduction of certain herniæ, by the contraction of these fleshy fibres, which having a tendency to straighten themselves, diminish the extent of the festoons or arches, and cause by this means the testis and hernial sac to ascend towards the ring, by acting upon them equally at all points, and often compressing them in a painful manner. Under these circumstances, the two fasciculi of the muscle somewhat resemble in their action that of the digastric muscle, in elevating the os hyoides.

The external fasciculus of the cremaster is almost constantly stronger than the internal. Sometimes they are equal in volume; it is very rare to find that the internal is the most developed, and I have only found it the case in three or four instances.

It occasionally happens that the internal fasciculus does not appear to exist; the reason is the following: the fleshy fibres which form the lower border of the internal oblique are inserted into the pubes by aponeurotic fibres which vary in length. If these latter are short, they are hidden by the internal column of the ring, and the corresponding fasciculus of the cremaster is plainly visible, and appears fleshy up to

its attachment. If, on the contrary, they are long, being, for instance, an inch or more in extent, this fasciculus at first sight appears deficient; but if the spermatic cord be drawn downwards, and outwards, the aponeurotic fibres are seen very distinct, and which, in the form of small white bundles, pass in a diverging manner from behind the internal column of the ring, and descend on the inner side of the cord. In proportion as these fibres descend, they augment in volume, and acquire a redder colour, and then ascend to compose the external fasciculus, which is entirely muscular.

These particulars may appear minute, but it is necessary to be acquainted with them, to explain the varieties which the muscular tunic, furnished by the cremaster muscle to the sac of inguinal hernia, presents.

In many subjects, notwithstanding the most attentive examination, I have been unable to discover the internal fasciculus of the cremaster.

In the female, the lower fibres of the internal oblique are much thinner than in the male; they pass above the round ligament without entering the inguinal ring: in the natural and healthy state, therefore, we find no trace of cremaster.[1]

The cremaster muscle is covered by the prolongation of the fascia superficialis, which passes downwards upon the spermatic cord, and more immediately by an expansion of very fine cellular tissue, which extends from the circumference of the external ring, and which becomes intimately connected with the cremaster; it is also applied upon the proper sheath of the cord,[2] to which, inferiorly, it becomes closely connected.

[1] In the female, the sac of an external inguinal hernia, in its descent, frequently carries with it the fibres of the internal oblique, and forms an accidental cremaster extended in front of the tumor, and the festoons of which, very pale, separated from each other, and scarcely visible from their thinness, unite into two triangular fasciculi at each angle of the ring, as in the male. A very careful dissection is required to discover these fibres, which are not equally developed in all cases. Often I have not succeeded in finding them.

[2] This sheath originating from the fascia transversalis, is a prolongation of the sort of infundibulum which the latter presents, to form the superior opening of the inguinal canal.

Superiorly, we may in most cases separate these two coverings from each other.

The inferior border of the internal oblique, is, in many subjects, so confounded with the transversalis, that we cannot be certain that the cremaster does not receive fibres from the latter muscle.

TRANSVERSALIS ABDOMINIS.

Beneath the internal oblique is the Transversalis; the lower part of which is attached externally to the inner border of the crista and anterior superior spine of the ilium, and also to the external part of Poupart's ligament. Its lower fibres are very thin, take a transverse direction, and terminate in an aponeurosis, which, passing inwards, is united to that of the internal oblique, which is placed in front of it. This aponeurosis is also extended in front of the rectus muscle,[1] to be attached to the linea alba, and to the upper part of the pubes, behind the internal column of the external ring, and the pyramidalis muscle.

The spermatic cord slides underneath the lower border of the transversalis muscle, on a level with the superior opening of the inguinal canal. "I have not succeeded," says Scarpa, "in determining accurately, whether or not the lower border of the transversalis muscle contributes in any way to the formation of the principal origin of the cremaster." I can assert, that in the majority of dissections which I have made, I have been unable to discover that such is the case. In a great number of subjects I have succeeded, though often with much difficulty, in separating the internal oblique from the transversalis, and I have almost always obtained the same result; in some cases, however, these muscles are found to be

[1] The aponeurosis of the transversalis, it is well known, passes behind the rectus muscle at its upper part; inferiorly it passes in front of it.

intimately united, and apparently forming conjointly the cremaster.[1]

The posterior surface of the transversalis is in relation with the Fascia Transversalis, which is an aponeurotic expansion hereafter to be described. They are usually connected together, through the medium of a dense cellular tissue. Frequently, indeed, it is impossible to separate them—both are attached to the outer part of the tendon of the rectus muscle.[2]

RECTUS ABDOMINIS.

The inferior extremity of this muscle terminates in a flat tendon; its breadth varies considerably, and it is inserted into the upper part of the pubes, posterior to the pyramidalis and the internal column of the inguinal ring. The outer edge of this tendon, (Plate III. c.) becomes thin, to give attachment, in most subjects, to a portion of the fascia transversalis, (Plate III. d.) Sometimes, however, this part of the rectus becomes received into a sheath formed by the fascia transversalis passing behind the muscle, and by the aponeurosis of the transversalis, which passes in front of it. Internally it is separated from its fellow by the linea alba.

[1] In two or three subjects, I have found that the transversalis muscle was not inserted either into the crural arch or into the pubes: its lower border was placed about two inches above the point where the spermatic cord enters the inguinal canal, and with which consequently it had no connexion. I have also seen the spermatic cord, on entering the inguinal canal, passing between the fibres of the transversalis muscle, the fibres being merely separated from each other, without accompanying the cord in the same manner as those of the internal oblique.

[2] In some instances, the transversalis muscle and the fascia transversalis are closely united at the external edge of the rectus; and then separating, furnish a complete sheath to the lower part of this muscle; the aponeurosis of the transversalis passes in front of it with the aponeuroses of the internal and external oblique; the fascia transversalis slides posteriorly to reach the linea alba: in such cases, the lower part of the rectus muscle is not in immediate contact with the peritoneum.

PYRAMIDALIS ABDOMINIS.

This little muscle is attached to the upper part of the pubes, behind the internal column of the inguinal ring, from which it is separated by the aponeurosis of the internal oblique, and is in front of the tendon of the rectus. It is separated from the latter by the aponeurosis of the transversalis, and is thus enclosed within a fibrous sheath. Superiorly, it ends in a point upon the linea alba.

FASCIA TRANSVERSALIS,

(Plate I. fig. 1, GG. fig. 3, C. Plate II. D.)

Towards the inguinal region, the posterior surface of the transversalis muscle is connected with an aponeurotic expansion, more or less developed in different subjects, and which separates it from the peritoneum. It is generally a fibrous expansion, but sometimes entirely cellular in its structure, arising from the posterior edge of the canal formed by the tendon of the external oblique, which appears to be first reflected backwards, and then superiorly to give origin to it. Above, this aponeurosis, which I shall term Fascia Transversalis, after Astley Cooper, who first described it, is insensibly lost in the cellular tissue covering the internal surface of the transversalis muscle, and which extends as far as the under part of the diaphragm. Internally it is attached to the external border of the rectus, which in this situation becomes thin to be continuous with it. Here also it possesses the greatest strength, (Plate I. fig. 3, E.) and is continued into the posterior layer of Gimbernat's ligament—its fibres, almost vertical, are, however, somewhat inclined inwardly. They are crossed by weaker fibres, which take a transverse direction. Below and externally the fascia transversalis, as I have said, takes its origin from the posterior edge of the tendon of the

external oblique; it also receives in this situation a lamina, more or less strong, from the aponeurosis which invests the iliacus internus muscle.[1]

Above and towards the middle of Poupart's ligament, the fascia transversalis presents an elongated aperture,* the great diameter of which is vertical, (Plate I. fig. 3, F.) Its internal edge, thicker and more strongly marked than its external, is sustained by falciform fibres, (Plate I. fig. 3, G.) detached from the arch itself. This orifice must not be considered as a simple foramen, but rather as the wide entrance to a funnel-shaped canal, (Plate I. fig. 1, Plate II. E.) which, in the male, receives the vessels of the spermatic cord, and of which it constitutes the sheath by extending over them. In the female, it gives passage to the round ligament of the uterus; it is of much smaller dimensions than in the male, and is sometimes with difficulty recognised. The sheath which it forms around the cord consists of a long cellular canal,† easily separable from it, descending with the spermatic vessels through the inguinal canal, and accompanying them to the upper border of the testis, where it becomes lost in the cellular tissue which surrounds the tunica vaginalis.

[1] The fascia transversalis is sometimes composed of two aponeurotic laminæ, united at the posterior border of Poupart's ligament: the anterior arises from Poupart's ligament itself; the posterior is continuous with the fascia iliaca, which quits the iliacus internus muscle to be reflected upon the anterior parietes of the abdomen. These two laminæ ascend together between the transversalis and peritoneum; they are easily separated on the outer side of the superior opening of the inguinal canal; whilst around, and on the inner side of this aperture, they are intimately united. When these two layers are distinct, the posterior usually passes behind the rectus to the linea alba, whilst the anterior is continuous with the outer edge of the rectus. The epigastric artery is found either in front or behind, and sometimes between the two layers.

* *Denominated either the Superior Opening of the Inguinal Canal, or the Internal Ring.* — T.

† *This fascia, with the cellular tissue which surrounds the spermatic vessels, has been described by different anatomists, and has received the various names of Fascia Canalis, Fascia Infundibuliformis, and Tunica Vaginalis of the cord. It affords a covering to the sac of an inguinal hernia, and to which it is considered by some authors to constitute a Fascia Propria.* — T.

Within the inguinal canal, the cellular sheath of the cord is covered anteriorly by the inferior fibres of the obliquus internus, which afterwards descend to constitute the cremaster. In most subjects they may be separated with tolerable facility; but sometimes the sheath of the cord is so strongly adherent to the cremaster, and to the cellular tissue, which is detached from the circumference of the ring, that it will not admit of separation.

This cellular sheath must not be confounded with the laminated cellular tissue, which unites the spermatic vessels, and which is derived from the external surface of the peritoneum.[1] This cellular tissue is connected very loosely with the internal surface of the sheath; on opening the latter longitudinally it may be easily detached; by distending the sheath with air we may convince ourselves that these parts are distinct, although points of connexion exist between them along the course of the spermatic cord.

The epigastric artery passes between the fascia transversalis, which is in front, and the peritoneum, which is behind.

The fascia transversalis then, is an aponeurosis, which varying[2] in thickness, arises from the posterior edge of Poupart's ligament, from the fascia iliaca, from the external edge of the tendon of the rectus muscle, and is continuous above with the cellular tissue situated upon the internal surface of the abdominal muscles; inferiorly and towards the middle of the crural arch it forms a membranous canal, which commences by a wide opening, directed posteriorly and externally, and of which the internal edge is much the stronger—this canal descends around the spermatic vessels to compose their proper sheath. The fascia transversalis supports the peritoneum behind, and is separated from it by the epigastric

[1] Occasionally, however, it is very difficult, and even impossible to distinguish this sheath from the cellular tissue upon the external surface of the peritoneum, and which accompanies the spermatic vessels.

[2] The fascia transversalis is in some individuals extremely thin; in others, towards the rectus muscle, it is composed of very strong bundles of fibres, so disposed, that open spaces, varying in form and number, are left between them.

artery [1]; in front it corresponds with the transversalis muscle, and with the aponeurosis of which it is often so intimately connected, that it can only be distinguished from it by the different direction of its fibres.

EPIGASTRIC VESSELS.

The Epigastric Artery, (Plate III. L L. Plate I. fig. 3. o), arising from the external iliac just as it passes under the crural arch [2], first takes a direction almost horizontally inwards, running upon the external angle of the superior aperture of the crural canal, and afterwards behind Poupart's ligament. The artery soon ascends towards the rectus muscle, crossing the direction of the spermatic cord, on a level with the superior opening of the inguinal canal, on the inner side of which it is situated [3]; it is also placed at about one inch to

[1] The fascia transversalis possesses the greatest strength between the superior opening of the inguinal canal and the rectus muscle. In this situation it is opposite to the posterior part of the inguinal ring, from which it is separated merely by the thin fibres of the internal oblique and transversalis, which are attached to the pubes.

[2] The epigastric artery arises either from the anterior, or from the internal side of the external iliac artery opposite to the crural arch; it may also be given off above or below this point: its origin is frequently by a trunk, which is common to it, and to the obturator artery. These points will be considered, when the parts connected with femoral hernia are described.

[3] In general the epigastric artery runs immediately upon the internal border of the superior aperture of the inguinal canal, so that the spermatic vessels on entering this canal, appear at first sight to wind round this artery, but which in reality supports them only in a very trifling degree. If we remove this vessel, we find in front of it the internal border of the opening in the fascia transversalis, which, in fact, is the part which sustains the cord, and which prevents its being carried inwards. In some subjects the epigastric artery is situated at the distance of four or five lines to the inner side of this opening, and is not at all in contact with the spermatic vessels at the point where they form a curve to enter the inguinal canal. The situation of the Umbilical Artery varies considerably. Converted into a fibrous cord, it is in some instances situated immediately on the inner side of the superior opening of the inguinal canal; in others, it is at some distance from it. We may conclude therefore, first, that the spermatic vessels are always sustained internally by the inner border of the opening in the fascia transversalis; secondly, that in most instances the epigastric artery contributes to their support; thirdly, that in some cases the umbilical artery assists these two parts in maintaining the cord in its situation.

the outer side of the inguinal ring.[1] Arriving at the external border of the rectus muscle, this vessel ascends behind it, and distributes to it most of its ramifications, which anastomose with those of the lumbar, intercostal and internal mammary arteries, &c. At the upper opening of the inguinal canal, it sends one or two small branches which pierce the fascia transversalis to be distributed to the cremaster, and to the sheath formed around the cord by the fascia superficialis; also two or three very small branches, which passing through the aperture in the fascia transversalis, are lost in the cellular tissue which connects the vessels of the cord and communicate with the spermatic arteries. These small branches of the epigastric present many varieties.

After having crossed the spermatic cord, the epigastric artery sends off one or two branches of tolerable size, which pass horizontally inwards, and anastomose behind the rectus muscle and the pubes, with similar ramifications from the opposite epigastric; it also communicates with the obturator arteries. Although the epigastric artery, as we have seen, passes most frequently between the fascia transversalis and peritoneum, it sometimes passes to the front of the former by a small aperture in that membrane; in other instances, by repeatedly penetrating the fascia transversalis, the artery is situated alternately anterior and posterior to it.

Before the epigastric artery reaches the rectus muscle, it forms the external boundary of a triangular space, (Plate I. fig. 3. K.) the base of which is formed by Poupart's ligament, and its internal border by the rectus muscle. The extent of this space is proportionate to the distance at which the epi-

[1] When, however, the inguinal ring is of considerable length, its external angle, or rather its summit, is situate only a few lines distant from the Epigastric artery. I will here observe, that the proximity of the external angle of the ring to the Epigastric artery is consequent on, 1st, the deviation of the artery from its proper course, as caused by an external inguinal hernia enclosed within the canal; 2ndly, the elongation of this angle towards the epigastric artery, which retains its proper situation as from an internal inguinal hernia; 3dly, these two parts, in some cases appearing to become opposite each other, and which we frequently observe in large external inguinal herniæ, where the obliquity of the inguinal canal is destroyed.

gastric artery is placed from the symphisis pubis. Internal inguinal herniæ * occur in the lower part of this triangular space, most frequently very near to the tendon of the rectus; it very rarely happens that the hernia is found on the outer side of the space, that is, near to the epigastric vessels.

In the majority of subjects we find two veins accompanying the epigastric artery, they are placed internally to it, and open either separately or by a single trunk into the external iliac vein. Occasionally they join the obturator vein, and anastomosing with its ramifications, form a venous net-work over the superior aperture of the crural canal: a single epigastric vein sometimes only exists.

Having separately described the different parts which compose the abdominal parietes towards the inguinal region, I shall now examine in what manner they mutually combine to form the inguinal canal.

INGUINAL CANAL.

From the foregoing description, it is manifest, that the spermatic cord takes its passage, not through a simple ring, but traverses really a complete canal—it is called the Inguinal Canal. The aponeurosis of the external oblique is reflected, as I have before said, posteriorly, and then upwards to give origin to the fascia transversalis; by this disposition, it forms with the latter a deep and narrow channel, the convexity of which is downwards and towards the crural canal, and rests in part upon the psoas and iliacus muscles—its concavity being directed upwards corresponds with the inguinal canal. This channel extends from the pubes to the anterior superior spine of the ilium; it gives attachment in nearly its whole length to the internal oblique and transversalis muscles; and further, it lodges in a portion of its extent the spermatic

* *Here it will be understood that M. Cloquet refers to the Direct or Ventro-Inguinal Hernia of English Anatomists, as distinguished from the External, Oblique, or Common Inguinal Hernia, in which the hernial protrusion following the course of the spermatic cord is situated on the outer side of the epigastric artery.*—T.

cord in the male, and the round ligament of the uterus in the female. Its anterior boundary is strong, and is formed by the aponeurosis of the external oblique; below and inwardly it presents near to the pubes, the opening called the inguinal ring; behind it is in contact with the internal oblique. The posterior boundary consists of the fascia transversalis, which ascends behind the transversalis muscle; it is pierced by the superior aperture of the inguinal canal, which is situated above and to the outer-side of the inferior opening, and is at the distance of about an inch and a half from it: this distance determines the length of the inguinal canal through which the cord runs obliquely. Between the superior aperture of this canal and the anterior superior spine of the ilium, the channel of the external oblique receives only the internal oblique and transversalis; between the superior orifice and the inferior, it forms the inguinal canal which contains these two muscles, and the spermatic cord; lastly, on the inner-side of the inguinal ring, it terminates upon the pubes at a little triangular space, bounded anteriorly by the internal column of the ring, posteriorly by the tendon of the rectus and the pyramidalis, and often by some radiated aponeurotic fibres, which ascend from the external column, in a diverging manner, to be attached to the lower part of the linea alba, after having passed behind the internal column of the ring. *

The external opening of the inguinal canal is below, on the inner side of, and a little anterior to the aperture by which the inguinal canal communicates with the abdominal cavity. It presents much variety in its extent, form, and in the strength of the aponeurotic fibres which constitute its boundaries, and which must influence the dimensions of the inguinal canal, the amount of resistance offered to the viscera in their protrusion, and the degree of strangulation which they may suffer. [1]

[1] I have already noticed many of the varieties in the formation of the inguinal ring; here I will observe that the extent of the inguinal canal bears an inverse ratio

* *These aponeurotic fibres have been termed the Triangular Fascia or Ligament, and are represented in Plate II.* I.—T.

The inguinal ring is surrounded by the fascia superficialis, as this passes from the abdomen to the spermatic cord. The fascia is but slightly adherent to the ring, and gives origin to a fibro-cellular expansion which covers the cremaster, and with which it soon becomes intimately connected to envelope the spermatic vessels already enclosed within their sheath. It is near this aperture that the fascia superficialis contains, as we have seen, the superficial pudic vessels derived from the femoral trunks, and which proceed towards the root of the penis and scrotum, some in front of, and others behind the spermatic cord. There also are found one or two filaments from the lumbar plexus of nerves, which pierce, first, the fascia transversalis on the outer side of the superior aperture of the inguinal canal, and afterwards the transversalis and internal oblique muscles, and descending in a direction parallel to the fibres of the latter, pass through the ring in front of the cremaster; they furnish some ramifications to the cord, and are lost upon the penis and scrotum.

The superior aperture of the inguinal canal, formed by the fascia transversalis, has already been described; it will be sufficient to repeat that it is much stronger on its inner side, which is supported by a fasciculus of aponeurotic fibres detached from Poupart's ligament, than on the outer side, where it is thin and cellular; its circumference gives rise to the funnel-shaped sheath, which receives the spermatic vessels, and accompanies them. Internally is the epigastric artery; superiorly it is bounded by the transversalis muscle, and below by the channel formed by the aponeurosis of the external oblique.

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to that of its inferior aperture. In some subjects, the ring extending to the centre of the crural arch, the cord, as it passes out, is placed at some distance from the pubes; the inguinal canal, then, having a direction from behind forwards, is very short, and the testicle can easily re-enter it. Frequently the fascia superficialis is united so loosely to the parts adjacent to the inguinal ring, that when the testicle is pushed upwards, it may become placed between that fascia and the aponeurosis of the external oblique. In examining such a case, we might be led to believe, that the testis has introduced itself into the inguinal canal; but if the gland be pushed downwards again, we do not discover the large opening, which permits the easy introduction of the finger, and which is formed by the dilated inguinal ring in the few individuals in whom the testes can really re-enter the canal.

The inguinal canal is wider, and its apertures are much more distinct in the male than in the female. Its direction, which usually corresponds with that of the crural arch, is also a little more oblique in the former than in the latter.[1] The occurrence of inguinal hernia is influenced by the differences in the dimensions of the inguinal canal, and which depend on the age and sex. In the numerous measurements which I have made of the parts which relate to this subject, I have obtained very nearly the same results as those published by Astley Cooper in the second part of his Treatise on Hernia.

	MALE.	FEMALE.
From the symphisis pubis	*Inches.*	*Inches.*
to the anterior superior spine of the ilium	$5\frac{3}{4}$	6
to the tuberosity of the pubes	$1\frac{1}{8}$	$1\frac{3}{8}$
to the inner margin of the external abdominal ring	$0\frac{7}{8}$	1
to the inner margin of the superior aperture of the inguinal canal	3	$3\frac{1}{4}$
to the middle of the iliac artery	$3\frac{1}{8}$	$3\frac{3}{8}$
to the middle of the iliac vein	$2\frac{5}{8}$	$2\frac{3}{4}$
to the origin of the epigastric artery	3	$3\frac{1}{4}$
to the point where the epigastric artery passes on the inner-side of the superior opening of the inguinal canal	$2\frac{3}{4}$	$2\frac{7}{8}$

Such is the ordinary result of the measurements which I have made: it is rare, however, to find two subjects in which they will exactly correspond.

In comparing the two inguinal canals, I have not hitherto discovered any difference in their conformation which would satisfactorily explain the greater frequency of hernia on the right than on the left side.

[1] If a horizontal line be drawn on a level with the pubes, and an oblique one from the symphisis pubis to the anterior superior spine of the ilium, it will be found that in the female, these two lines will meet at a more acute angle than in the male, and which depends on the less degree of elevation and the greater breadth of the pelvis in the former: in the female, also, the crural arch is more horizontal. This difference, however, is not striking in many individuals.

SPERMATIC CORD.

The Spermatic Vessels which are placed behind the peritoneum descend from the lumbar region in front of the psoas and iliacus muscles, to the superior opening of the inguinal canal. There they unite with the vas deferens (Plate I. fig. 3. i.) at an angle more or less acute, and form with this duct the spermatic cord. The vas deferens within the inguinal canal is situated posterior to, and on the inner side of the blood vessels and lymphatics of the cord.

The spermatic vessels, on entering the inguinal canal, immediately take a direction downwards and a little forwards, thus forming an angle at the superior aperture. Enclosed within the sheath, which is derived from the latter, they pass beneath the inferior border of the transversalis, and afterwards beneath the fibres of the internal oblique,—sometimes, however, passing between the fibres of this last muscle by which they are then enveloped. They next pass out through the inferior aperture of the canal, and changing their direction over the pubes form a second angle. We may consider that the vessels of the spermatic cord follow three different directions: running first downwards, forwards, and a little outwards, from the lumbar region to the inguinal canal; next, downwards, forwards, and inwards, within the canal itself; and, in the last place, directly downwards from the ring to the testicle.

The spermatic vessels, on leaving the inguinal canal, are enclosed within their sheath, and covered by the fibres of the internal oblique which compose the cremaster. They also receive the cellular expansion detached from the ring, and the covering of fascia superficialis. Towards the cavity of the abdomen, the point at which the spermatic vessels pass into the canal is marked by a conical depression of the peritoneum, which has the form of a little funnel, (Plate I. fig. 1. m.) and frequently sends a prolongation in front of the cord. In the majority of subjects, however, the peritoneum passes over the

superior aperture of the inguinal canal without being extended into its interior.

PERITONEUM.

The anterior parietes of the abdomen are lined by the Peritoneum, which descends behind the crural arch and the rectus muscle into the iliac region and interior of the pelvis. The peritoneum in this situation presents two fossæ, which are separated from each other by a sort of partition, which is supported by the umbilical ligament.[1]

This partition consists simply of a broad triangular fold, which extends upwards and inwards from the cavity of the pelvis and sides of the bladder to the umbilicus. Its base is situated inferiorly; its summit is insensibly lost at a varying distance below the umbilicus. Its free edge is concave and strong, particularly below; it is directed backwards and outwards, and is supported by the umbilical ligament; its anterior border is adherent.

One of the fossæ, which the peritoneum presents in this region, is internal and of small dimensions: internally, it is separated from the corresponding one of the opposite side by the urachus, and by a small triangular fold which the latter frequently forms by raising the peritoneum. The other superior and external is larger and deeper than the preceding; it is of a triangular form, and represents a kind of hollow pyramid, the base of which is directed posteriorly and outwards, and the

[1] This fibrous cord is formed by the umbilical artery of the fœtus, which is obliterated at the time of birth. I have frequently found it terminating in fibres so delicate that they could not be traced as far as the umbilicus: they appeared to be lost in the cellular tissue covering the external surface of the peritoneum. It is not unusual to find the two umbilical ligaments uniting to form one fasciculus at the distance of one or two inches below the navel, and then ascending with the urachus. My opinion is, that this disposition of the parts is congenital; for in one fœtus, I found the umbilical arteries joining to form one trunk before their exit from the abdomen. The inferior part of the umbilical ligament is almost invariably pervious to furnish some vesical arteries.

summit forwards and inwards, corresponding frequently [1] with the little depression of the peritoneum which indicates the point where the spermatic vessels enter the inguinal canal. [2]

[1] I say *frequently*, for these relations are not uniform. There is no part which varies more in its situation than the umbilical ligament; and the same observation will apply to the size, form, and direction of the peritoneal fold which this ligament determines, as well as to the disposition of the fossæ in question. When the umbilical ligament is widely separated from that of the opposite side, the peritoneal fold which it supports is very considerable, and the fossæ are of great depth, especially the superior. In some subjects, I found that the latter formed a large pouch, which contained many convolutions of small intestines, or a portion of the omentum. Occasionally, however, the umbilical ligament is closely adherent in its whole extent to the abdominal parietes; the peritoneum is then but little raised to form the falciform duplicature, and the fossæ are but slightly marked.

In the majority of cases the umbilical ligament is situated behind the epigastric artery; in some instances it is an inch or an inch and a half to its inner side, and passes posterior to Gimbernat's ligament. Its relation to internal inguinal and crural herniæ therefore varies; it is always situated on the inner side of the neck of external inguinal hernia.

[2] This little depression is occasionally situated at the distance of five or six lines to the outer side of the opening in the fascia transversalis. In many subjects I have discovered it lying in front of the spermatic vessels in the iliac fossa to which it had probably been drawn. In most instances this depression does not correspond with the apex of the pyramid formed by the larger of the two fossæ, which extends more internally. Occasionally it is continuous with a cellular filament, which consists of the remains of the tunica vaginalis *, or more properly of its canal of communication with the peritoneum in the fœtus. I have met with the remains of the tunica vaginalis in male subjects of all ages; and it is a singular circumstance that they should be nearly as frequently found in the old as in the young subject. The following are the principal varieties which have occurred to my observation.

1st. The little depression of the peritoneum adheres simply to the spermatic cord, in front of which it is always situated, through the medium of a dense cellular tissue which extends upon the cord in the form of a whitish filament, which becomes thinner and thinner, and is soon lost in the cellular membrane which unites the spermatic vessels.—(Plate IV. fig. 1. A.)

2dly. The depression of the peritoneum is continuous with a long whitish cord, of a fibro-cellular texture, which may be traced as far as the tunica vaginalis.—(Plate IV. fig. 2. A.)

3dly. This cord, instead of being solid throughout its whole extent, presents at different points oblong sacculi, two, three, or four in number, separated from each

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* *By the term Tunica Vaginalis, I presume, M. Cloquet here refers to the prolongation of peritoneum, which was drawn down by the testis at the period of its descent.*—T.

The depression of the peritoneum at the superior aperture of the inguinal canal exists also in the female. It is adherent to the round ligament, and frequently sends in front of it a small white filament, or a narrow membranous tube (canal of Nuck), which presents the closest analogy to the processes connected with the tunica vaginalis in the male.

Such is the most ordinary disposition of the peritoneum in the region of the groin.

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other by contracted portions. These cavities usually communicate with each other by very narrow orifices, and will admit of inflation.—(Plate IV. fig. 3.)

4thly. There exists often only one oblong cavity, of an inch or an inch and a half in length, either entirely contained within the inguinal canal, or projecting from it in a trifling degree, large at its fundus, and continuous with the peritoneum by a narrow neck, or sort of pedicle, which sometimes contains a small canal by which the cavity may be inflated, but which at other times is solid. In this case, the cavity does not communicate with the peritoneum, and represents a kind of cyst, which might be mistaken for the remains of a hernial sac.—(Plate IV. fig. 6.) At the point where the pedicle is attached, the peritoneum presents a small cicatrix, more or less marked. The parietes of this cyst, and of the others just mentioned, are more or less thin, transparent, and elastic; occasionally they are white, opaque, and easily torn; their interior is moistened by serum, which may increase in quantity, and form encysted hydroceles of the cord.

5thly. I have many times seen the tunica vaginalis very much elongated, and extending upwards in front of the cord, into the inguinal canal, to become continuous with the depression of the peritoneum through the intervention of a solid cellular fasciculus.—(Plate IV. fig. 4.)

In all these cases, the tunica vaginalis is completely separated from the peritoneum; it may, however, preserve a communication with that membrane. The depression which the latter presents is then continuous with a canal which is either long and contracted at different points, or short and wide, and consists simply of the upper extremity of the tunica vaginalis. This canal allows the serum of the abdomen to flow into the tunica vaginalis, thus forming a hydrocele. It may also become the sac of a hernial protrusion.

DESCRIPTION

OF THE PARTS

CONCERNED IN FEMORAL HERNIA.

The Os Innominatum presents anteriorly a broad excavation, which is bounded on the outer side by the anterior superior spine of the ilium, and internally by the spine of the pubes. The lower border of the aponeurosis of the external oblique, extended between these two points, constitutes, as we have seen, a fibrous cord, (the Crural Arch), which converts this excavation into a triangular aperture through which muscles, vessels, and nerves pass between the abdomen and thigh.

The line of this excavation of the os innominatum has a direction downwards, inwards, and forwards, so that its outer boundary formed by the anterior superior spine of the ilium is external, superior and posterior; its other boundary formed by the spine of the pubes is internal, inferior, and anterior. The space comprised between these two points is a little more considerable in the female than in the male: in the latter, the distance between the anterior superior spine of the ilium and the spine of the pubes is from four inches and a half to five inches. The anterior superior spine [1] is separated from the anterior inferior spine [2] of the ilium by a slight de-

[1] The anterior superior spine of the ilium gives attachment at its middle to the sartorius; superiorly to the crural arch; externally to the fascia lata and its tensor muscle; internally to the iliacus internus.

[2] This spine gives origin to the rectus femoris muscle.

pression. The latter eminence is more or less prominent in different subjects; it is bounded anteriorly by a hollow surface which extends downwards and inwards as far as the linea-ilio-pectinea.[1] Between the latter and the spine of the pubes, and above the cotyloid cavity, is another slight excavated surface, horizontal, smooth, and triangular, narrow internally, and broad on the outer side. This surface belongs to the transverse portion of the pubes; it is bounded in front by a jutting border or crista, which ascends from the cotyloid cavity and the obturator foramen towards the spine of the pubes, and to which the pectinalis muscle is attached; posteriorly, it is bounded by the brim of the pelvis, and by a rough oblique line which proceeds from the spine of the pubes backwards and outwards; and after a course of about half an inch, becomes continuous with the brim. This projecting line may be termed the crista of the pubes; it affords attachment to an aponeurotic expansion, which will hereafter be described. (See Gimbernat's ligament.)

The surface just described is of particular importance as relating to the subject of crural hernia; it is entirely covered by the pectinalis, which is attached to it as high as the brim of the pelvis: the femoral vessels lie upon this muscle. On the inner side of the spine of the pubes is a rough horizontal border of about an inch in length.[2] It is united at a right angle, (angle of the pubes), with the vertical and oblong articular surface, which contributes to form the symphisis pubis.

I have pointed out the manner in which the aponeurosis of the external oblique contributes to the formation of the inguinal canal; it now remains for me to show how it takes a

[1] The linea-ilio-pectinea is the line where the ilium and the pubes unite. It gives attachment to the tendon of the psoas parvus, or to an aponeurosis, when this muscle is wanting. The hollow surface between the linea-ilio-pectinea and the anterior inferior spine of the ilium is continuous with the iliac fossa.

[2] This part of the pubes corresponds with the base of the triangle, which the inguinal ring represents; upon its surface the spermatic cord in the male, and the round ligament in the female, rest.

part in the formation of the opening through which a femoral hernia takes place.

In addition to the principal attachment of Poupart's ligament to the spine of the pubes, it also has an insertion into the crista of this bone by means of a fibrous triangular expansion, (Plate I. fig. 3. R. Plate III. U.), which is detached from its posterior part. This expansion has a direction almost horizontal in the upright posture of the body, so that it has an anterior border and rather superior, which is fixed to the crural arch; and a posterior inferior border, which is attached to the whole length of the crista of the pubes. Its base turned outwards corresponds with the iliac vessels; it is thin, rather concave, and is continuous with a fibrous lamina more or less strong, which I shall presently consider, — its summit is narrow and terminates at the spine of the pubes; this ligament, therefore, fills internally the triangular space between the pubes and the crural arch.

This expansion must not be considered as distinct from the crural arch; for, as the latter approaches the pubes, it increases in breadth, to be fixed to its spine and crista by means of this expansion, which appears to be reflected beneath the inferior column of the inguinal ring.

The ligament now described varies in dimensions; ordinarily its great diameter is from six to ten lines. Dr. Monro observes, that its strength is greater in the male than in the female, and to this he refers the comparatively rare occurrence of femoral hernia in the former; this observation, however, is not invariably correct: in some females I have found the ligament stronger and broader than in many males; in other instances, it has presented no differences in the two sexes. In some subjects this expansion of the crural arch is entirely cellular; in others, it does not even exist; occasionally it possesses considerable strength. It is almost constantly perforated by one or many small apertures for the passage of lymphatic vessels, at the point where it is continuous with the anterior wall of the crural canal, as will be afterwards seen.

A careful dissection of this ligament, which I shall call Gimbernat's ligament[1], will show that it consists in most subjects of two distinct laminæ, easily separable above, but intimately connected below, to be inserted together into the crista of the pubes. Of these two laminæ, one is posterior and deep, — it is continuous with the fascia transversalis, and the tendon of the rectus abdominis; the other is anterior and superficial; and is continued into the inferior column of the ring. A correct knowledge of the structure of Gimbernat's ligament is obtained by dissecting it towards the inguinal canal.

In examining the crural arch, we perceive that its anterior border presents a straight line, extended from the ilium to the spine of the pubes, whilst its posterior border is concave, in consequence of the aponeurotic expansion sent off from it to the crista of the pubes, and which constitutes Gimbernat's ligament.

The triangular space situated between the crural arch and the great excavation of the ilium is filled externally by the united psoas and iliacus muscles, which, in their course from the abdomen to the thigh, pass between the anterior inferior spine of the bone and the linea-ilio-pectinea. They are retained in this position by an aponeurotic expansion of great strength, which is detached from the tendon of the psoas parvus, or which arises insensibly upon their anterior surfaces when the latter muscle is wanting.

The tendon of the psoas parvus, lying at first in front of the psoas magnus, soon descends on the inner side of it, and increasing in breadth, is attached to the linea-ilio-pectinea. It thus separates the psoas magnus, which is on the outer side from the pectinalis, which is placed inwardly. From the ex-

[1] This ligament was described by Gimbernat, in a work which he published at Madrid in 1793, entitled, "Nuevo Metodo de operar en la Hernia Crural," &c.; and subsequently by English anatomists, under the name of "Gimbernat's Ligament."—(See Hey's Practical Observations.)

ternal border of this tendon an aponeurosis of some strength, takes its origin, which is fixed externally to the whole of the inner border of the crista of the ilium, between the iliacus internus and the transversalis abdominis; inferiorly, where it is much stronger, it is attached behind the crural arch, becoming continuous with the fascia transversalis[1]: it also descends beneath the crural arch, in front of the psoas and iliacus, as I shall describe.

The tendon of the Psoas Parvus sends off another aponeurosis, which is internal and posterior to the preceding; it is attached to the superior boundary of the pelvis, and confines very closely the psoas magnus; it is much stronger anteriorly and towards the pubes, where it is continuous with the fascia lata covering the pectinalis, than posteriorly towards the sacrum, where it is thin and sometimes of a cellular structure. From its attachment to the upper boundary of the pelvis it descends into this cavity, investing the levator ani and forms at the obturator foramen an inverted arch for the passage of the obturator vessels and nerve. Astley Cooper has demonstrated this aponeurosis, and has given it the name of Fascia Iliaca: it may be regarded as one of the origins of the fascia lata, which becomes continuous with it beneath the crural arch, covering the psoas and iliacus as well as the anterior crural nerve. In this situation it is covered by the iliac vessels, to which it is connected by cellular tissue, varying in density; and further, presents an aperture for the passage of the circumflexa ilii vessels.

The pelvic aponeurosis (Fascia Iliaca) in passing to the thigh, forms between the crural arch and the psoas muscle a border, which limits externally the superior opening of the

[1] By its continuity with the fascia transversalis, this aponeurosis represents a fibrous cul-de-sac, which occupies the angle formed by the iliacus internus, and the anterior wall of the abdomen; and is a powerful means of preventing the escape of the viscera beneath the outer part of the crural arch. If these aponeuroses be removed, the peritoneum can easily be pushed forward between the crural arch and the iliacus muscle.

crural canal, whilst Gimbernat's ligament limits it internally.[1]

I leave for the present the further description of this aponeurosis, in order to consider the Crural Canal.

In dissecting the upper and anterior crural region, which might be called the inferior inguinal, we meet, in proceeding from without inwards, 1st, the skin; 2ndly, adipose cellular tissue, which, in some individuals, may form a layer of two inches in thickness; 3rdly, the fascia superficialis, of which I have already spoken; 4thly, beneath the latter, the fascia lata which in this region has two origins, each by a distinct layer. The two layers which constitute these origins are separated from each other; the one, anterior and superficial, is fixed to the inferior border of the crural arch, and passes in front of the femoral vessels, (Plate II. u.; the same layer reflected in Plate III. s.), whilst the other, posterior and deep, (Plate II. z.), glides under these vessels, to be attached to the pubes, covering the pectinalis muscle, and becoming continuous at the linea-ilio-pectinea with that portion of the fascia iliaca which descends in front of the psoas and iliacus muscles. These two layers, by their separation, form a fibrous canal, which I shall call the crural canal, giving passage to the femoral artery and vein, and containing also absorbent vessels and glands.

The anterior layer of the fascia lata arising from the crural arch, and passing in front of the femoral vessels, presents below this arch an Oval Aperture, which the Vena Saphena (Plate III. k.), placed in front of the fascia lata, enters to join the femoral vein. (Plate II. x.)

This aponeurotic aperture varies considerably as to its distance below Poupart's ligament, and also in its dimensions and form; in some instances it is separated from it by a con-

[1] To understand this disposition of the parts, the iliac vessels must be removed; and on examining from the cavity of the abdomen, the continuity between the pelvic aponeurosis and the fascia lata is seen. Beneath the crural arch we find a falciform fold, the concavity of which is towards Gimbernat's ligament. — (See Plate I. fig. 3. s.)

siderable space, the extent of which is determined by the point where the vena saphena unites with the femoral vein. I have generally observed that this aperture is nearer to the crural arch in the female than in the male; its great diameter, which is vertical, is from six to ten lines in length; its small diameter is transverse, and measures about eight lines; its upper extremity, not very clearly defined, in some subjects, is separated from the crural arch by an interval of only three or four lines; in others, the distance amounts to an inch or an inch and a half. The inferior extremity is formed by an aponeurotic semi-lunar fold, strong and distinct, (Plate II. Y.), the concavity of which is directed upwards towards the crural arch, and is received into the angle formed by the junction of the vena saphena and femoral vein.[1] This crescentic edge* is continuous externally with that portion of the fascia lata which covers the outer part of the thigh, as also with the anterior layer of the fascia, which ascends to be attached to the crural arch, (Plate II. U.) Internally, the crescentic edge is continuous (Plate II. Z. Plate III. X.) with the posterior layer of the fascia lata, which, covering the pectinalis and adductor longus, is attached to the pubes; it is also continuous with the superficial portion of the same fascia which constitutes the anterior wall of the crural canal, (Plate II. 4.) We here distinguish clearly the separation of the fascia lata into two layers; one ascending obliquely inwards and towards the inferior border of the crural arch and the lower column of the external ring, and covering the femoral vessels, whilst the other takes a direction beneath them to be attached to the pubes.[2]

[1] To bring into view the lower border of the opening of the vena saphena, it is necessary simply to raise the vein, and to separate it from the subjacent fascia lata, up to the point of its union with the femoral vein.

[2] This layer is attached to the posterior edge of the triangular surface, which is covered by the pectinalis muscle, — that is, to a portion of the brim of the pelvis, and in front of the crista of the pubes.

* *This is generally termed the Falciform Process, or Semi-lunar Edge of the Fascia Lata.* — T.

The superficial layer of the fascia lata crosses in some degree the direction of the deeper-seated one; it dips beneath the crural arch to be continued into Gimbernat's ligament.[1] When the thigh is extended, and rotated outwards, the superficial layer of the fascia lata, composing the anterior part of the crural canal, is in the most complete state of tension; at the same time, the crural arch is stretched, and drawn downwards without producing much effect upon Gimbernat's ligament. By the flexion and rotation inwards of the thigh the opposite effects will be produced.

In my opinion, it is not correct to consider as a mere ring, the aperture through which the external iliac vessels leave the abdomen. These vessels, passing from the abdomen between the pubes and the inferior border of the aponeurosis of the external oblique, are received into an aponeurotic canal, which is prolonged over them at the anterior and internal part of the thigh. This Canal is as perfect as the inguinal, and a correct idea of it is essential to the knowledge of the anatomy of femoral hernia. I shall describe successively its two Apertures and its walls; afterwards, the form, dimensions, direction, and relations of this Canal, as also some varieties which I have met with in different subjects.[2]

[1] In some subjects the continuation of the superficial layer with Gimbernat's ligament, is entirely cellular; and the aperture of the vena saphena in these instances is of large size, and of an irregular form. The layer in question presents a large falciform edge, the upper extremity of which becomes contracted to be inserted beneath the inferior pillar of the ring: the lower extremity supports the vena saphena by its concavity.

[2] To obtain a view of the Crural Canal, it is necessary, after the removal of the skin, fascia superficialis, and inguinal glands, to expose the superficial layer of the fascia lata, which forms its anterior wall, and the aperture of the vena saphena, which forms its inferior opening. The abdomen is next to be opened by a large crucial incision, and the peritoneum to be removed from the inguinal region: by this means the fascia transversalis, the posterior surface of the crural canal, the fascia iliaca, and Gimbernat's ligament, are exhibited, (Plate I. fig. 3.) The cellular tissue and iliac vessels being removed, a vertical incision is then to be made through the superficial layer of the fascia lata, extending from the crural arch (which is to be left entire) downwards to the aperture which gives passage to the vena

The Superior Aperture of the Crural Canal is situated above the pubes; it is triangular, inclines downwards and forwards, and presents three borders and three angles, (Plate I. fig. 3. Q.) One of these borders is anterior and superior; this is the longest; and is formed by the crural arch, (Plate I. fig. 3. L. Plate III. R.) The two others, are, one posterior and internal, the other, posterior and external.

The posterior and internal border is the shortest; it corresponds with the upper edge of the pubes, (Plate III. V.) and with the deep layer of the fascia lata, which is attached to that part, and is here remarkably thick.*

The posterior external border is of an intermediate length, compared with the two preceding. It is formed by the expansion of the tendon of the psoas parvus, (pelvic aponeurosis), which descends beneath the crural arch, and accompanies the united psoas and iliacus muscles.

Of the three angles, the internal is formed by Gimbernat's ligament; the external, by the concave aponeurotic fold, which is in the opposite direction, between the crural arch and the psoas and iliacus. The posterior is not clearly defined, and corresponds with the linea ilio-pectinea.

Walls of the crural canal. — This canal extends between the opening just described, and that which gives passage to the vena saphena. Its length varies, and depends upon the height at which this vein opens into the femoral; it measures from six to fifteen lines. Its direction is nearly vertical; it is triangular, and wider above than below. In the female it is a little shorter, but generally wider than in the male.

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saphena. By separating the divided edges of the fascia, and removing the femoral vessels with the vena saphena, the posterior walls of the Crural Canal will be brought into view.

* *This is denominated by Sir Astley Cooper, Ligament of the Pubes.* T.

The crural canal presents three walls: the anterior * extends from the crural arch to the upper part of the opening for the vena saphena (Plate II. 4.), and is formed by the superficial layer of the fascia lata, which ascends in front of the femoral vessels; it is much stronger externally than on the inner side, where it is continuous with the deep layer of the same fascia, and with Gimbernat's ligament.[1] It is covered by skin, subcutaneous cellular tissue, and fascia superficialis; it adheres closely to the latter at its lower part. In front of it also are absorbent glands, and the superficial vessels of the groin. It covers the femoral artery and vein, and usually sends between these vessels two fibro-cellular partitions, which form the sheath of the vessels, and are attached to the posterior external wall of the crural canal. On the inner side of the femoral vessels, and between the anterior and the posterior internal walls is the space, through which the sac of a femoral hernia escapes; this space, however, is closed superiorly towards the abdomen by a septum, presently to be described.

Of the two posterior walls of the crural canal, the internal is formed by the deep layer of the fascia lata; it is narrow, and covered a little externally by the femoral vein: in front, it is separated from the anterior wall by the space just mentioned. Small round apertures are sometimes found in it, for the passage of lymphatics. Internally, it is united with the anterior wall, and is also continuous with the fascia lata, covering the muscles on the inner part of the thigh.

The posterior external wall is slightly convex and narrow, and is formed by the aponeurotic expansion of the psoas parvus,

[1] In some subjects, this wall is rather thin, and is perforated by numerous foramina, for the passage of the arteries, veins, and lymphatics of the groin. One of these apertures, of greater size than the others, is situated near to Gimbernat's ligament; it is occupied by large lymphatic trunks; through it also the sac of femoral hernia frequently escapes.

* *The anterior boundary or wall of the crural canal is described by Sir Astley Cooper as being derived from the fascia transversalis, which is continued, he says, downwards beneath Poupart's ligament. It has been named Fascia Cribrosa, in consequence of its being perforated by small holes for the passage of blood vessels and lymphatics.* See Plate II. 4.—T.

which covers the psoas and iliacus muscles and crural nerve: the femoral vessels and lymphatic trunks rest upon it.

Inferior Aperture (Plate II. x.)—The Inferior Aperture of the crural canal is formed by the Opening in the fascia lata, which gives passage to the Vena Saphena. This aperture, already described in part, is oval, and not very clearly defined; it sends a fibro-cellular prolongation (Plate II. 3.) over the upper part of the vena saphena, and which is continuous with the fascia superficialis. Inferiorly, its edge is strong and well defined, and supports the angle formed by the union of the vena saphena and femoral vein. By its continuity with the fascia superficialis, which covers it, a sort of half-spiral turn is formed, which, however, is not equally manifest in all subjects.[1] Besides the fascia superficialis, absorbent glands, varying in size and situation, are also placed in front of this aperture. It gives passage to lymphatics and to subcutaneous arteries and veins belonging to the genital organs, and to the integuments of the groin and abdomen. Below it, the fascia lata passes externally (Plate II. 7.) upon the sartorius muscle, to which it furnishes a sheath; internally, it extends upon the adductor longus.

It is evident from the foregoing description of the crural canal, that, in the first place, its direction is vertical in the greater part of its extent; secondly, that its superior aperture is directed upwards and backwards towards the abdominal cavity, whilst its inferior (the opening for the vena saphena) has a direction forwards. The canal, therefore, possesses three different axes, which, by their union, represent tolerably well the form of the letter Z, the superior branch of which, resting upon the pubes, would form the axis of the superior aperture of the canal, and which has a direction downwards and forwards. Its middle branch would represent that of the canal itself, which is vertical, whilst the inferior would pass out directly forwards, through the opening for the vena saphena,

[1] At the opening for the vena saphena, the femoral vein is immediately covered, to a small extent, by the fascia superficialis.

in a direction corresponding with the axis of this aperture. An accurate acquaintance with the different axes of the crural canal is useful, for they determine the direction and form of crural hernia when it occupies the whole extent of the canal, and escapes by the inferior aperture. Such knowledge is also necessary in the employment of the taxis, &c.

The External Iliac Artery and Vein pass beneath the crural arch, towards its middle, in their progress to the thigh, where they take the name of Femoral. Within the crural canal, they rest upon its two posterior walls, but principally upon the posterior external; they are confined in this situation by two laminæ, fibrous or cellular, which extend obliquely between the anterior and the posterior external walls of the crural canal. One of these laminæ is placed between the femoral artery and vein; the other * passes on the inner side of the latter, and is lost in the surrounding cellular tissue, and in the septum, which closes the entrance of the crural canal. These two laminæ constitute the sheath of the femoral vessels, and are continued upon them. [1]

In their passage beneath the crural arch, the external iliac vessels furnish, on the outer side, the circumflexa ilii artery and vein, and on the inner side, the epigastric. The latter (Plate I. fig. 3. o. Plate III. L.) pass obliquely behind the external angle of the superior aperture of the crural canal, and ascend inwards to the rectus muscle; — their relations to the inguinal canal have been already considered. The epigastric artery often arises by a trunk, which is common to it and to the obturator; the latter vessel, however, more frequently is

[1] In some subjects these two laminæ are fibrous, very strong, and retain the femoral vessels firmly in their situation. If the anterior wall of the crural canal be removed, and these vessels raised, we find on the posterior walls three longitudinal grooves, separated by little projections, which are the remains of these laminæ. The external groove receives the femoral artery, the middle the femoral vein, and the internal is occupied by the lymphatic glands and vessels; it is in the last groove that the sac of crural hernia generally descends. The anterior crural nerve passes under the crural arch, between the psoas and iliacus; it is situated on the outer side of the crural canal, and is separated from the vessels by its posterior and external wall.

* *This lamina, or partition, placed on the inner side of the femoral vein, would separate this vessel from the sac of a crural hernia.*—T.

furnished by the hypogastric itself, or one of its branches, and has then no connexion with the crural canal. When there exists a common trunk for these two vessels, they usually separate from each other on the outer side of the superior aperture of the crural canal; occasionally, however, on its inner side, but rarely below that opening. In the first case, the Obturator artery [1] takes a direction downwards and inwards towards the thyroid foramen, (Plate I. fig. 3. v.) and is completely on the outer side of the superior aperture of the crural canal. In the second case, this artery (Plate I. fig. 3. x.) descends almost vertically behind the superior aperture, its proximity to Gimbernat's ligament then depending upon the length of the common trunk. Lastly, in the third case, the common trunk passes into the crural canal, or perhaps takes its origin within it, and the two branches derived from it re-enter the abdomen; the obturator artery, more or less tortuous, ascends, and turns over the upper border of the pubes into the cavity of the pelvis, towards the thyroid foramen; the epigastric artery turning underneath the crural arch, then runs upwards and inwards towards the rectus muscle. These varieties in the origin of the obturator artery, determine its relations to the sac of a crural hernia. [2]

[1] The course of the obturator artery is shown by the dotted lines in Plate I. fig. 3. v. x.

[2] I have studied with much care the relations which the epigastric, obturator, or their common trunks may have with regard to the crural canal; I have drawn and described the most interesting varieties in these arteries, both in the healthy state and in crural hernia; further, I have endeavoured to establish, in a given number of subjects, the proportion in which the obturator artery arises from the hypogastric, from the external iliac, or from the epigastric; with that view, I have examined these vessels in two hundred and fifty subjects, the half of which were males. The following were the results obtained: —

Obturator artery, arising from	1st. Hypogastric on both sides.....	in 160 subjects,	87 males, 73 females.
	2nd. Epigastric on both sides.....	in 56 subjects,	21 males, 35 females.
	3rd. Hypogastric on one side; from the Epigastric on the other..	in 28 subjects,	15 males, 13 females.
	4th. The Femoral	in 6 subjects,	2 males, 4 females.
	Total	250 subjects,	125 males, 125 females.

Frequently the obturator artery arises on one side by a common trunk with the epigastric, on the other from the internal iliac; it rarely proceeds directly from the external iliac. Many varieties are observable in the anastomoses of the epigastric with the obturator vessels, and with those of the opposite side; they often form a net-work upon the posterior surface of the pubes.

The superior orifice of the crural canal is closed by a membranous septum, which tends to prevent the occurrence of femoral hernia, and opposes the entrance of the finger when we endeavour to introduce it from above downwards, beneath the crural arch. This septum constitutes, in some subjects, a sort of fibro-cellular partition, of a very firm and resisting nature; in others, it is of a thin cellular structure, and easily yields to the pressure of the finger. I propose to give it the name of Septum Crurale.* The following is its usual disposition:—it arises from the circumference of the superior aperture of the crural canal; it is tolerably thick; its fibres are generally transverse anteriorly, and towards the crural arch; internally it is derived from the cellular tissue, behind Gimbernat's ligament, and, perhaps, even from the concave

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The following is the relative proportion of cases in which the obturator has or has not a relation with the hernial sac—placing on one side the cases of obturator arising from the epigastric, or directly from the femoral; and on the other, those arising from the hypogastric, we find

Obturator artery arising	From the Hypogastric	in 348 subjects,	191 males, 157 females.
	From the Epigastric or Femoral	in 152 subjects,	58 males, 94 females.
	Total	500	

From this calculation we find, 1st, that the cases in which the obturator takes its origin from the hypogastric are the most numerous; that their proportion, when compared with those in which it arises from the epigastric or femoral, is nearly as three to one. 2ndly, That the obturator appears to arise more frequently from the hypogastric in the male than in the female.

* *The Septum Crurale is the Cribriform Fascia of Sir Astley Cooper, and contributes to form the Fascia Propria of femoral hernia. Sir Astley describes it as becoming consolidated with the anterior part of the sheath of the femoral vessels.*—T.

edge of the latter, conjointly with the anterior boundary of the crural canal; externally it is confounded with the sheath of the femoral vessels, and with the cellular tissue which surrounds the epigastric artery. On the outer side of this artery we find also that the interval between the crural arch and the femoral vessels is filled with cellular membrane.

The upper surface of the Septum Crurale is towards the abdominal cavity; it is concave: the inferior, directed towards the crural canal, is convex: each surface is, however, sometimes level. This septum is always perforated by small apertures for the passage of lymphatics, and which are sometimes so numerous, that the superior part of the canal appears to be closed simply by a fibro-cellular net-work. One of these apertures, more considerable than the others, is central, and is sometimes occupied by an elongated absorbent gland; it is sufficiently large to admit the point of the little finger, which, when introduced, will be girt by it as by an elastic fibrous ring. Internally, another tolerably large foramen is also sometimes found, near to Gimbernat's ligament.[1]

The absorbent vessels and glands of the groin vary as to their number and situation, as well as in their mode of communication. In front of the anterior wall of the crural canal there are absorbent glands, which communicate with others which are placed behind it; they cover the opening for the vena saphena, and are continued into the crural canal to accompany the femoral vessels: there are usually one or two, of an elongated form, situated in the groove, which separates the external iliac artery from the vein, where they enter the crural canal. The lymphatic trunks form in this canal a net-work more or less considerable, which, being interwoven with small veins and the septum crurale, afford an obstacle to any protrusion of the abdominal viscera.

The superior orifice of the crural canal usually corresponds with the lower part of the external fossa, which the perito-

[1] The sac of femoral hernia sometimes pushes before it the septum crurale; at other times it protrudes through one of its apertures, which may then become a cause of stricture.

neum forms in the inguinal region. When, however, the umbilical artery is placed at a considerable distance from the linea alba, it may be in relation to the internal fossa.[1] The peritoneum simply passes over this aperture, and presents sometimes at the level of it a slight depression; it rests upon the septum crurale, from which it may be separated with facility, as the cellular tissue, which connects them, is very loose in texture.

[1] Femoral hernia most frequently takes place external to, rarely on the inner side of the umbilical artery.

THE END.

Fig. 1.

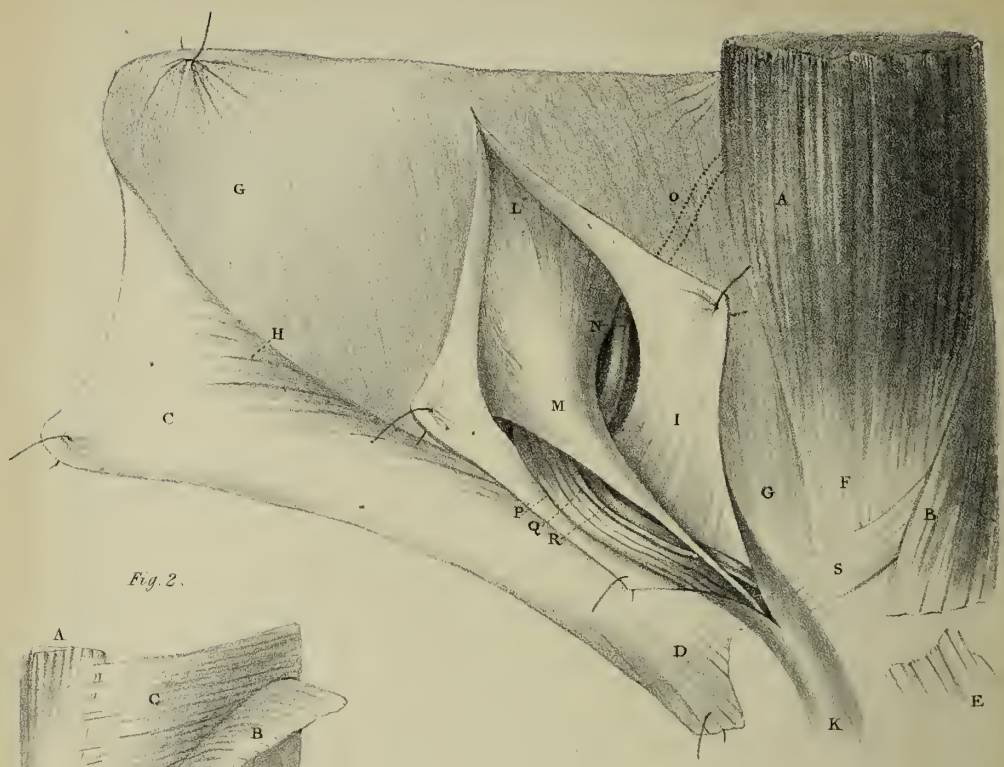


Fig. 2.

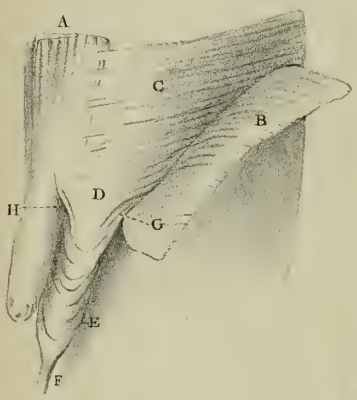
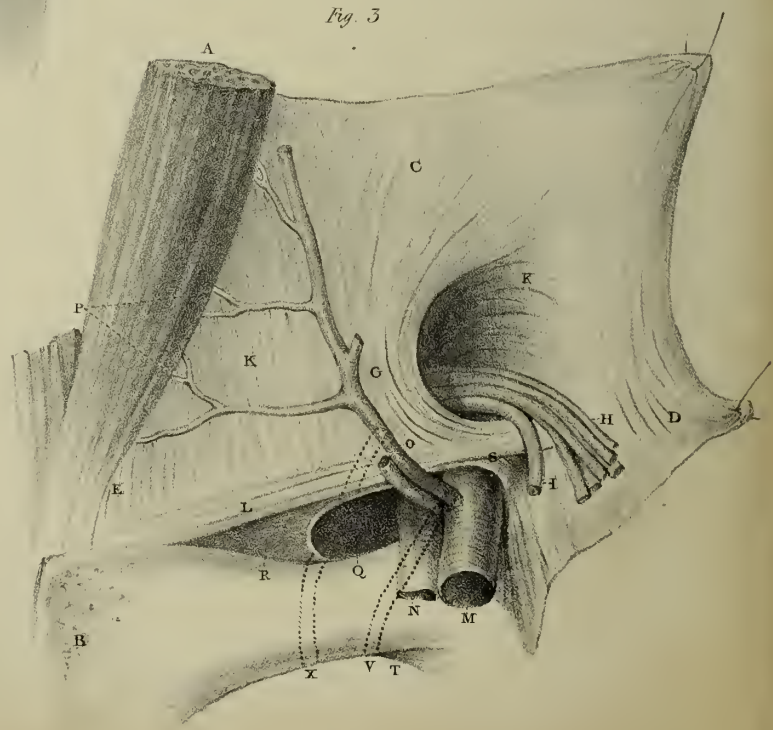


Fig. 3



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EXPLANATION OF THE PLATES.

PLATE I.

FIG. 1.

Anterior View of the Superior Opening of the Inguinal Canal on the right side.

A. Rectus abdominis.
B. Pyramidalis.
C. Aponeurosis of the obliquus externus turned downwards upon the thigh.
D. Internal column of the inguinal ring divided and reflected.
E. Remaining fibres of the internal column.
F. Tendon of the rectus continuous with the fascia transversalis.
GG. Fascia transversalis.
H. Aponeurosis of the obliquus externus continuous with the fascia transversalis.
I. Funnel-shaped canal formed by the fascia transversalis, opened anteriorly, in order to bring into view the spermatic vessels which it encloses.
K. Proper sheath of the spermatic vessels derived from the fascia transversalis.
L. Peritoneum covering the posterior surface of the fascia transversalis.
M. Prolongation of the peritoneum, which sometimes extends in front of the spermatic cord.
N. Epigastric artery, passing between the peritoneum and the fascia transversalis.
O. Dotted outline indicating the course of the epigastric artery, behind the fascia transversalis.
P. Spermatic veins.
Q. Spermatic artery.
R. Vas deferens.
S. Fasciculus of fibres belonging to the obliquus externus.

FIG. 2.

Disposition of the Obliquus Internus and Cremaster, in the Fœtus of seven or eight Months.

A. Rectus abdominis.
B. Aponeurosis of the obliquus externus turned downwards.
C. Obliquus internus.
D. Lower border of the internal oblique becoming curved, to form the cremaster.
E. Inverted arches formed by the fibres of the obliquus internus, which constitute the cremaster.
F. Part of the gubernaculum testis.
G. External fasciculus of the cremaster.
H. Internal fasciculus.

FIG. 3.

Posterior View of the Superior Openings of the Inguinal and Crural Canals, on the right side.

A. Part of the rectus abdominis.
B. Posterior surface of the pubes.
C. Fascia transversalis.
D. Fascia iliaca continuous with the fascia transversalis.
E. Fascia transversalis continuous below with the tendon of the rectus, and with the crural arch.
F. Superior opening of the inguinal canal, formed by the fascia transversalis.
G. Fasciculus of fibres, forming the inner margin of the superior opening of the inguinal canal.
H. Spermatic vessels.
I. Vas deferens joining the other vessels of the cord at an acute angle.
K. Triangular space, bounded externally by the epigastric artery; internally, by the rectus muscle; and inferiorly, by the crural arch. In this situation internal inguinal hernia takes place.
L. Posterior surface of the crural arch.
M External iliac artery.
N. External iliac vein.
O. Epigastric artery. The epigastric vein has been divided.
P. Branches of the epigastric artery to rectus muscle.
Q. Superior opening of the crural canal.

R. Gimbernat's ligament.

S. Concave fibrous fold, forming the external angle of the superior opening of the crural canal, and situated opposite to Gimbernat's ligament.

T. Upper part of the obturator foramen.

V. Dotted outline, indicating the course which the obturator artery most frequently takes, when it arises from the epigastric. Here the obturator artery would be situated to the outer side of the sac of a femoral hernia.

X. Dotted outline, indicating the course of the obturator artery, when the common trunk which furnishes this artery and the epigastric is of considerable length. In such a case, the obturator artery descends behind Gimbernat's ligament, and passes first above, and then on the inner side of the neck of the sac in femoral hernia.

PLATE II.

Represents the Inguinal and Crural Canals of the right side.

A. Rectus abdominis.

B. Tendon of the rectus, continuous externally with the fascia transversalis.

C. Aponeurosis of the obliquus externus detached and turned down upon the thigh.

D. Fascia transversalis.

E. Funnel-shaped prolongation of the fascia transversalis around the spermatic vessels, to form their sheath. It has been opened at its upper and anterior part.

F. Proper sheath of the spermatic vessels.

GG. Fascia transversalis arising from the posterior border of the aponeurosis of the external oblique (crural arch,) and with which it forms a deep channel.

H. Obliquus internus and transversalis muscles divided close to their attachment to the crural arch.

I. Radiating fibres which terminate inwardly the canal of the external oblique, and which passing behind the internal column of the inguinal ring, are attached to the linea alba.

K. Internal pillar of the inguinal ring attached to the front part of the symphisis pubis.

M. Spermatic vessels surrounded by their sheath, and covered by the fibres of the cremaster muscle.

NN. Inverted loops or arches formed by the fibres of the cremaster muscle.

O. Internal fasciculus of the cremaster passing behind the inner column of the inguinal ring, to be fixed to the pubes.

P. External fasciculus of the cremaster passing out of the corresponding part of the inguinal ring.

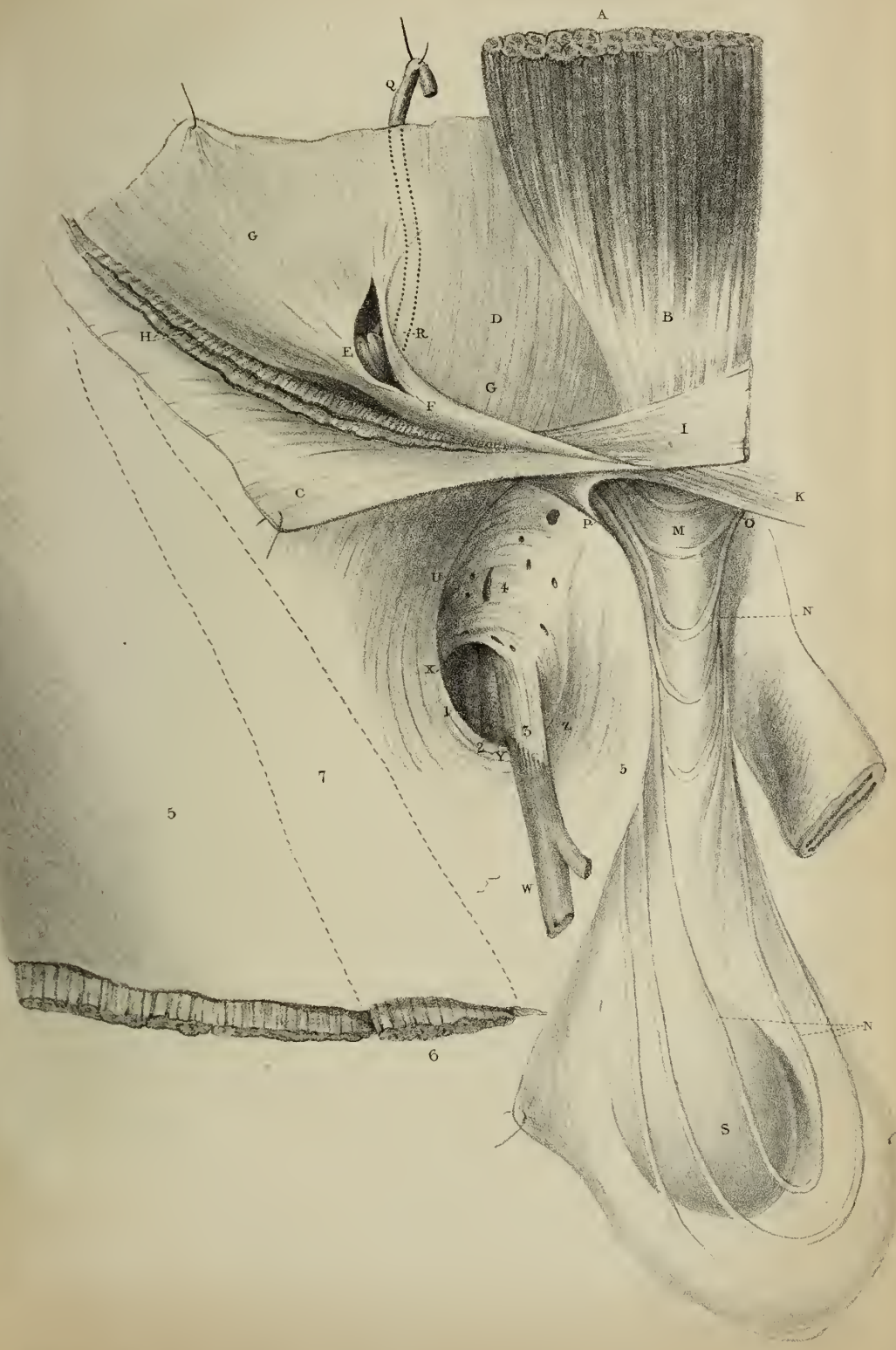
Q. Epigastric artery.

R. Dotted outline indicating the course of the epigastric artery behind the fascia transversalis, after having crossed the direction of the spermatic vessels.

S. Testis.

U. Superficial layer of the fascia lata which is fixed to the crural arch and forms the anterior wall of the crural canal.

W. Vena saphena.



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X. Aperture in the fascia lata which gives passage to the vena saphena, and which forms the inferior opening of the crural canal.

Y. Strong semi-lunar edge of the inferior opening of the crural canal which supports the angle formed by the union of the vena saphena and femoral vein.

Z. Point at which the deep and superficial layers of the fascia lata join each other.

1. Femoral artery.—Ordinarily this artery is entirely covered by the superficial layer of the fascia lata,—the femoral vein only being seen through the inferior opening of the crural canal.

2 Femoral vein.

3. Fibro-cellular prolongation from the opening of the vena saphena which descends upon this vein, and becomes intimately connected with the fascia superficialis.

4. Anterior wall of the crural canal. The small apertures in it are represented which give passage to blood-vessels and lymphatics.

5 5. Fascia lata covering the muscles of the thigh.

6. Sartorius muscle.

7. Dotted lines indicating the situation of the sartorius muscle beneath the fascia lata.

PLATE III.

View of the Inguinal Region on the right side.

A. Rectus abdominis.
B. Pyramidalis.
C. Tendon of the rectus.
D. Portion of the fascia transversalis.
E. Aponeurosis of the external oblique muscle.
F. Another portion of the fascia transversalis.
G. External iliac artery and vein.
HH. Femoral artery.
II. Femoral vein.
K. Vena saphena uniting with the femoral vein.
L. Epigastric artery. The vein has been divided.
MM. Spermatic vessels.
N. Vas deferens, forming an angle at its union with the blood vessels of the testis.
O. Part of the proper sheath of the spermatic cord.
P. Spine of the pubes, giving insertion to the external or inferior column of the inguinal ring.
Q. Superior aperture of the crural canal.
R. Lower border of the aponeurosis of the external oblique forming the crural arch.
S. Superficial layer of the fascia lata detached from the crural arch, and reflected in order to exhibit the deep layer of the same aponeurosis, the crural canal and the femoral vessels.
T. Deep layer of the fascia lata forming the posterior wall of the crural canal.
V. The same layer fixed to the crista and superior border of the pubes.
U. Gimbernat's ligament.
W. Sartorius muscle.
Y. Semi-lunar edge, which forms the lower boundary of the inferior aperture of the crural canal.
Z. Fascia lata covering the sartorius muscle.

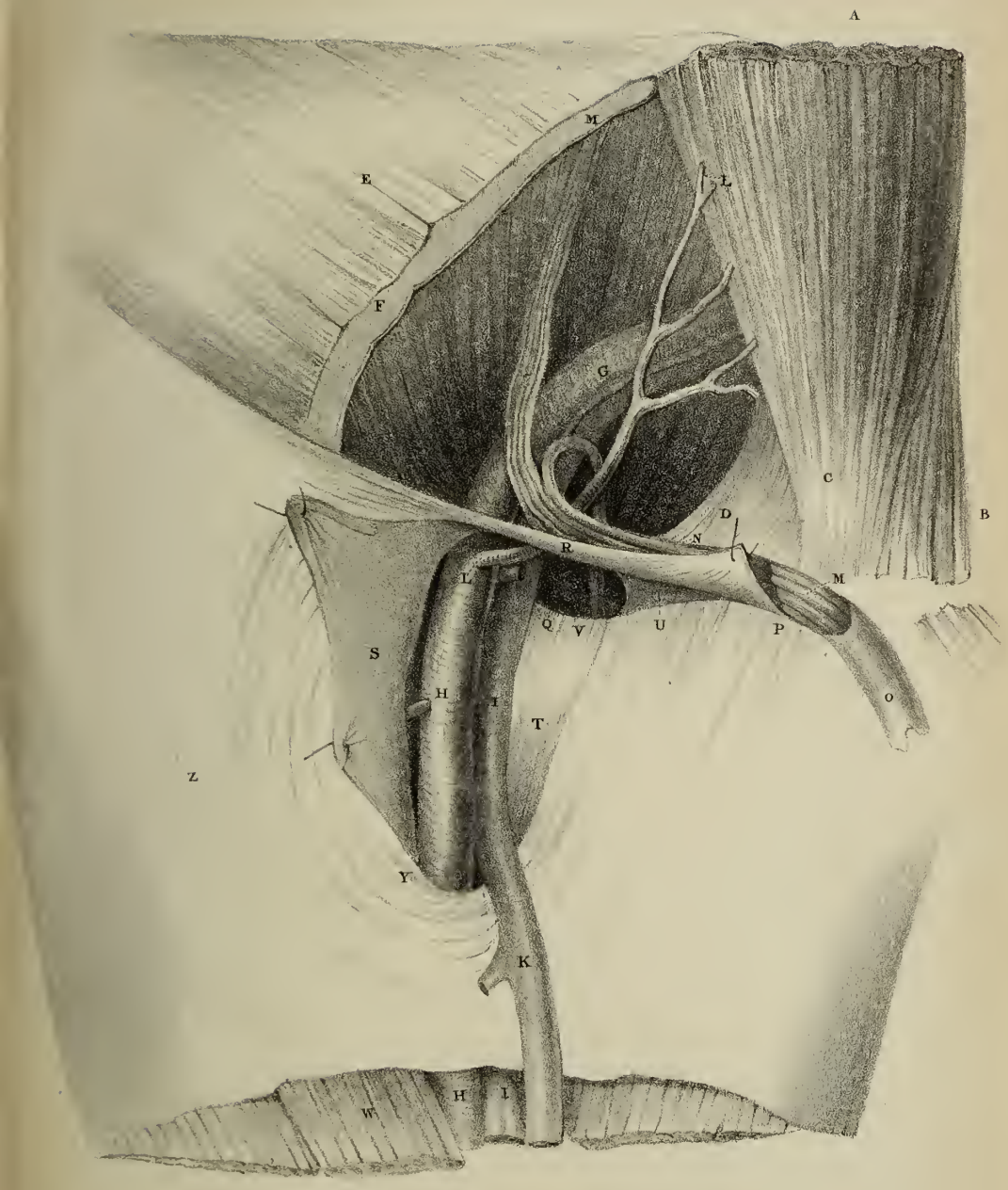

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Fig. 1.

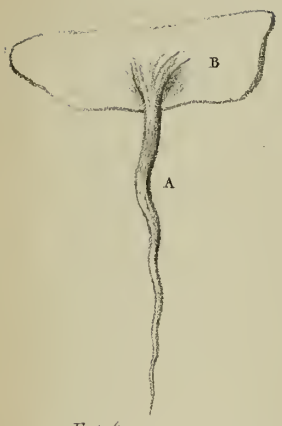

Fig. 2.

Fig. 3.

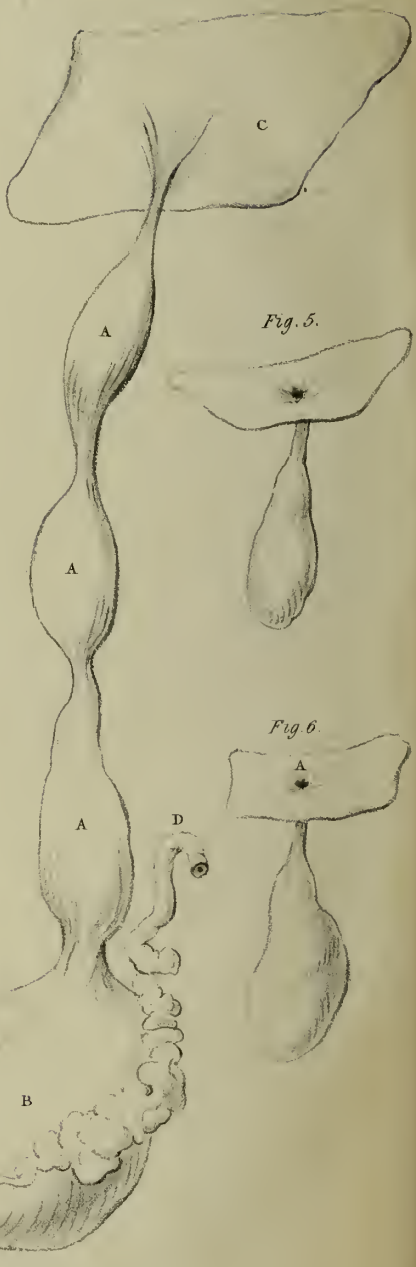

Fig. 4

Fig. 5.

Fig. 6.

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PLATE IV.

The principal varieties which I have found in the Prolongation, which the Peritoneum frequently sends down in front of the Vessels of the Spermatic Cord.

FIG. 1.

A. Fibro-cellular cord of a whitish colour, terminating insensibly in a point in front of the spermatic vessels, and continuous with the external surface of the peritoneum.

B. Part of the peritoneum which covered the superior opening of the inguinal canal.

From a male subject about fifty years of age.

FIG. 2.

A. Prolongation of the peritoneum of much greater extent than the last. It is a fibrous cord continuous above with the peritoneum B, and below with the summit of the tunica vaginalis C.

D. Vas deferens.

From a male subject advanced in age.

FIG. 3.

Fibro-cellular cord, extending between the peritoneum and the tunica vaginalis, containing three serous cavities AAA, which have been distended with air. The inferior cavity is continuous with the tunica vaginalis, B.

C. Part of the peritoneum.

D. Vas deferens.

From a very old male subject.

FIG. 4.

A. Short fibrous prolongation of the peritoneum, continuous with the elongated summit of the tunica vaginalis, which ascends as high as the inguinal canal.

B. Peritoneum.

C. Tunica vaginalis.

D. Vas deferens.

From the body of a young man.

FIG. 5.

Small serous ampulla, which sometimes extends from the peritoneum into the inguinal canal in the female, and which accompanies the round ligament.

From a female, aged about 20 *years.*

FIG. 6.

Serous cyst, sometimes found in front of the spermatic vessels, and very much resembling an obliterated hernial sac.

A. Small creatrix which the peritoneum presents at the point where it is continuous with the cyst.

From the body of an adult male.

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